# Minutes
# Methane Hydrates Advisory Committee
# Washington, DC
# April 24-25, 2006

## Monday, April 24, 2006

## 1. Introduction

The joint meeting of the Methane Hydrate Advisory Committee (MHAC) and the Interagency Coordinating Committee (ICC) was called to order at 9:05 AM, Monday, April 24, 2006, by Mr. James Slutz, Deputy Assistance Secretary for Oil and Natural Gas and the Designated Federal Officer (DFO). Mr. Slutz began the meeting by allowing all present to introduce themselves (See attached attendee list). Since the previous Committee expired in September 2005, but was renewed in the Energy Policy Act of 2005, a new chairman was needed. As the first order of business, Mr. Slutz opened the floor for nominations and election of the MHAC chairman. Since there were several new members to the Committee, it was decided to table nominations and election of the MHAC chairman until the afternoon. Having served as chairman of the Committee in the past, Mr. Arthur Johnson of Hydrate Energy International volunteered to serve as the interim chairman and this was agreed to by the Committee. The duties of the chairman – manage meetings, perform follow-up work after the meetings, testify before Congress, draft advisory letter to the secretary of Energy, among other duties – were discussed. Mr. Johnson stressed that he enjoyed his time as chairman in the past and stressed that the main focus of the chair is to help the Committee reach consensus.

As the next order of business, Mr. Slutz provided background on the scope of the Committee. The key points were:

- MHAC was renewed in EPACT 2005 and is a Federal Advisory Committee, and therefore falls under the requirements of the Federal Advisory Committee Act.
- The Department of Energy, and the Federal Government, in general, looks to MHAC as an independent body to review the DOE Methane Hydrate Program and the overall Federal Government methane hydrate activities.
- MHAC does not recommend projects but reviews the strategic direction of government research and development (R&D) and provides advice, such as where additional funding may be necessary, what are the programs strengths, or what new areas of research are needed.

The question was raised on how MHAC ties in with the activities of the National Petroleum Council (NPC), which also reviewed methane hydrates in a recent report and had a different viewpoint than some of the MHAC members. It was noted that MHAC and the NPC are two different committees, but it may be beneficial if MHAC provides input to the NPC on methane hydrates in the future. It was noted that the wording of the

MHAC duties were slightly different in the current EPACT2005 and the Methane Hydrate R&D Act of 2000 (P.L.106-193).

The discussion then turned to the next topic, which was a series of presentations by ICC members on their methane hydrate activities.

## 2. Presentations

### 2.1 Mr. Joe Benneche, Energy Information Administration (EIA) – AEO2006 natural Gas Projections for the Reference, Price, LNG and Technology Cases

Mr. Joe Benneche presented EIA's natural gas projections from their Annual Energy Outlook 2006. First and foremost, he noted that EIA does not forecast what will happen but what might happen based on trends. For methane hydrates, EIA is assuming that methane hydrates do not contribute to natural gas supply during the time period analyzed (2005 to 2030). According to EIA's reference case, the main driver for natural gas in the future will be electricity generation. EIA assumes that the technically recoverable natural gas resources in the United States are 1,315 trillion cubic feet (TCF) or about a 70-year supply at current production levels. The sources of incremental U.S. natural gas supply are projected to come from growth in unconventional resources such as coalbed methane, tight sands, and Devonian shale, LNG imports, and Alaskan production. Most of the imports of natural gas in the United States will come from LNG, with supply from Canada expected to decline from current levels.

Mr. Benneche next presented EIA's price sensitivity projections. At low natural gas prices, electricity generation capacity and consumption, net imports, and net imports of LNG all increased relative to the reference case. At higher prices, each was lower relative to the reference case, with coal accounting for a greater amount of electricity generation capacity and consumption.

For the LNG cases, high imports of LNG resulted in lower natural gas wellhead prices, higher consumption, and less domestic production of natural gas. Low imports of LNG resulted in higher natural gas wellhead prices, lower consumption, and higher domestic production.

EIA's technology cases assume either slow or rapid technology. For rapid technology development, net imports decrease, wellhead prices decrease, and domestic production and consumption increase. For slow technology development, wellhead prices are higher, imports increase, and domestic production and consumption are lower relative to the reference case.

Several questions and comments were made during Mr. Benneche's presentation. One comment noted that the AEO2000 and the AEO2006 cases look much different, and this is a relatively short time period, reflecting the difficulty in understanding prices. The question was asked if LNG imports would result in an upward price spike for natural gas. Mr. Benneche responded by saying that LNG is a "price taker," competing with higher

cost alternatives. He noted that higher prices typically bring in more LNG, thereby reducing the price.

Several questions were raised on how EIA accounts for higher prices and the potential introduction of new technologies or resources as a result of higher prices. Mr. Benneche stated that, for the reference case, EIA assumes that technology improves with time at historical rates, and does not include feedback that higher prices lead to more technology improvements in their analyses. He said that it is difficult to tie a particular technology to the drivers. He mentioned that past attempts were made to tie R&D spending to technology improvements but it was difficult. Another comment was made that it took coalbed methane 20 years before it reach a level of commercial maturity and that there were three primary reasons: Federal spending, particularly for basic science, tax incentives, and companies with leadership willing to take the risk. Today, coalbed methane production is no longer viewed as unconventional by industry and that a similar path could potentially be followed for methane hydrate production. There were several comments suggesting the EIA price estimates were too conservative, for example having listed a current annual price of US$60/BBL oil, when the actual price was US$75/BBL.

**2.2 Dr. Ray Boswell, Department of Energy (DOE) / National Energy Technology Laboratory (NETL) – DOE Program in Natural Gas Hydrates**

Dr. Boswell provided a presentation on the DOE Natural Gas Hydrate Program. The presentation focused on the Federal interest in hydrate R&D, DOE funding, goals of the program and key projects.

The Federal interest in hydrate R&D is focused on three areas: understanding the role hydrates in the environment, understanding their economic significance, and expanding international R&D. Dr. Boswell provided a chart of DOE's investment in natural gas hydrate R&D since 1999 and noted that funding has been relatively stable around $10 million annually; however, he noted that the current request to Congress for FY2007 is zero.

Both mid- (~2015) and long-term (~2025) goals for the DOE program were identified. The goals were delineated into the following key areas of focus: enabling production, drilling safety, the environment, education, and global leadership. Regarding production, Dr. Boswell showed that the resource potential is huge for natural gas hydrates, but the technical and economic recoverability needs to be proven. DOE's goals take a step-approach to determining the recoverability by first determining if recoverable hydrate exists at a meaningful scale. Next, DOE will determine if methane is recoverable from Arctic hydrate on the Alaskan North Slope (ANS). Finally, the program would determine the recoverability of marine hydrates in the Gulf of Mexico and assess prospects for expansion.

Dr. Boswell also noted that safety and the environment are very important aspects of the program. Additionally, he noted that education is important and that the National Research Council encourages greater emphasis in this area. Finally, he noted that the

program is active in international activities to leverage valuable R&D funds and to have access to additional information, data, and technical capabilities.

Dr. Boswell concluded his presentation by focusing on key projects of the DOE program. The projects are focused on characterization of hydrates principally in field studies; on development of technology such as exploratory tools, numerical models, and production technology; and on transferring information to industry and the scientific community.

The comments and questions during Dr. Boswell's presentation focused on funding. A member of the MHAC asked if there was anything the committee could do to help the funding issue. The MHAC was reminded that they are prohibited by law from lobbying for funding, and their role is to provide advice to the Secretary of Energy. Another member asked how the program would reach its 2008 goal without funding for 2007. Dr. Boswell replied that the program is working on the assumption that they will have funding. He cited that the uncertainty of funding for the program leads to delays in program action or short time requirements for solicitations, proposals, etc. A member of the committee also said this is a problem for their organization because funding comes late, accessibility is lacking, and the short timeframe for proposal responses do not give the organizations much time to put together teams. Another question on the budget focused on a Congressionally earmarked project, its importance, and what was the expected output. The project would focus on monitoring seafloor conditions in the Gulf of Mexico, which lead to further discussion on Congressional earmarks in general, particularly what they are, since some in the group were unfamiliar.

An additional comment focused on international activities and if the results will be made available to the public. Dr. Boswell replied that required data and information would be available. A comment was made that it is important that the U.S. guide international efforts so that information is made available.

### 2.3 Ms. Brenda Pierce, United States Geological Survey (USGS) – USGS Activities in Natural Gas Hydrates

Ms. Pierce made a presentation on USGS activities in natural gas hydrates, emphasizing their studies and activities. Her presentation focused on USGS projects in Alaska, the Federal Outer Continental Shelf (OCS), international activities, and five-year study plan.

USGS is evaluating ANS gas hydrates in two projects. One project is being conducted in three-phases to assess the economically recoverable resource potential of gas hydrates and associated free-gas accumulations in northern Alaska. The project will gradually move from in-place assessments of the resource to technically recoverable resource to, finally, economically recoverable resources. Technically recoverable resources were defined as those resources which could be recovered with current technology. Phase was completed in FY05 and Phase 2 will be completed in FY07 and Phase 3 in FY08. The second Alaska project will characterize, quantify, and determine the commerciality of gas hydrate and associated free-gas resources in arctic regions, focusing on the Kuparuk River Area of the Prudhoe Bay. Various data and results from this project were presented. Ms. Pierce noted that results from the Mallik 2002 production test well in the

Mackenzie Delta region of Canada were feeding into much of the ANS work of the USGS.

USGS is cooperating with the Minerals Management Service on gas hydrates assessments for the OCS. These activities are focused on the Gulf of Mexico and the Cascadia Basin located in the Pacific Northwest and British Columbia, Canada. Much of the USGS work in the Gulf of Mexico is through the Joint Industry Project (JIP), which involves both government and industry researchers and scientists and brings together various scientific and engineering disciplines in a systematic approach. The Cascadia Basin project will study the formation of natural gas hydrates in marine sediments and investigate various geochemical, physical, and biological aspects.

USGS has been active in international activities such as the Mallik project and currently with the government of India. Most of the data, with the exception of the 3-D seismic data would be available from the activities with India. India is very serious about gas hydrate production and is actively pursuing commercial production with a goal of 2008. Supporting India is in the U.S. interest because the experience could help U.S. commercialization efforts.

Another key aspect of Ms. Pierce's presentation was the five-year plan of study by the USGS for gas hydrates. The plan had four main goals:

- Contributed to understanding the energy resource potential of onshore and offshore gas hydrates
- Assess the role of gas hydrates in seafloor stability
- Assess the role of gas hydrates in global climate change
- Expedite project and information management for USGS gas hydrates research

Ms. Pierce was asked why the goal for commercial production in India was 2008 and in the United States, 2015. She answered that India has less energy resources and has more motivation. Additionally, they are spending more funds on gas hydrate development. During this discussion, it was noted that technically, methane hydrate resources could be produced now and that production technology is not a barrier. For example, the Mallik project and USGS ANS projects are using conventional technology. Rather, the bigger issue is infrastructure and the capability to move methane produced from hydrates to market.

A question was asked on what level USGS funds gas hydrate research and what would it take to get more support. Ms. Pierce replied that funding is currently about $2 million per year in base funds and that future funding looks promising, considering the current budget climate. There was some concern raised that there is an inconsistency in the amount of funds compared to the time and participation by USGS activities. Ms. Pierce agreed that USGS is stretched too thin, regarding manpower, and they are hiring, but there has been concern about the budget.

### 2.4 Mr. Robert LaBelle, Minerals Management Service (MMS) – MMS Gas Hydrate Initiatives 2006

Mr. LaBelle reviewed MMS hydrate activities and that they are focusing on the MMS Hydrate Assessment/Evaluation Model, in-place resource assessment, technically recoverable estimates, environmental assessment, protection and monitoring, and exploration and production activities, including offshore safety. MMS estimates that the in-place gas hydrates resource in the Unites States totals over 320,000 TCF, with offshore accounting for over 319,500 TCF of this total. Over half of this in-place resource is on the Alaska OCS, with the Gulf of Mexico, Pacific OCS, and Atlantic OCS accounting for the rest of the offshore resource. The small fraction of onshore resource is in Alaska.

Since 1995, there has been a significant increase in the number of leases in the deepwater Gulf of Mexico (i.e., > 800 M water depth). For deepwater conventional oil and gas operations, known areas of hydrates are typically avoided because of the potential for hydrate-related drilling problems, such as plugged lines and other safety problems.

A key focus of MMS's activities is to protect resources, which include biological communities on Department of Interior managed lands and waters. Mr. LaBelle presented the results from research studies that MMS has done on the environmental communities located in deepwaters near gas hydrates. MMS has found that chemosynthetic fauna associated with Gulf of Mexico hydrocarbon seeps are similar to those of hydrothermal vents. The upper depth limits for Gulf of Mexico chemosynthetic communities is between 400 and 500 M, and currents at relevant depths can disperse larvae across the entire upper continental slope. Remote sensing surveys can narrow and refine search patterns. Gas hydrates are more important to seep community ecology than anticipated.

In conclusion, Mr. LaBelle highlighted some of the major questions that still need to be answered concerning biological communities. He cited the National Ocean Partnership Program (NOPP) as a potential answer. MMS is providing over $3 million from its science funding to the Program over 4 years to fund hardware that can reach depths greater than 1000 M to explore the biological communities at these depths.

Most of the questions and comments during Mr. LaBelle's presentation focused on MMS environmental work and their resource assessments. A comment was raised that there is a concern that environmental overlegislation, or protecting species that do not need protecting, may be possible regarding biological communities located near potential sites of gas hydrate production. The chemosynthetic communities which were originally thought to be rare are quite common. Mr. LaBelle responded that, because MMS is a government agency, it is required to comply with the National Environmental Policy Act when it undertakes a project, whether it is for new resources such as gas hydrates or conventional natural gas. A question was asked on what MMS has found so far regarding its deeper water efforts and environmental/biological communities that exist there. Mr. LaBelle said so far the communities look more conventional than originally thought.

Regarding MMS's resource assessment activities, Mr. LaBelle was asked how MMS plans to tighten up its estimates. He responded that they are using seismic data and that the assessment to be released in December 2006 will have probabilities at 5% and 95% in

addition to a mean value. He stressed that MMS will keep working on this subject to accurately estimate the values. Other questions focused on production incentives for gas hydrates and if there was a tendency to move away from deepwater to arctic technology for gas hydrates. Mr. LaBelle said that MMS released a call for questions and comments regarding royalty relief for hydrates and enhanced oil recovery, but not many comments were received, but it would be helpful to get additional information. He said that he was not aware of any tendency to move away from deepwater to arctic technology, noting that the Gulf of Mexico has extensive oil and gas infrastructure available. In response to a question, Mr. LaBelle also indicated that new findings on the Sulfate-Methane-Interface were included to suggest the top of hydrate reservoirs, just as the BSR suggests the bottom of such reservoirs.

**2.5 Mr. Bob Fisk, Bureau of Land Management (BLM) – Remote Sensing for Gas Hydrate Studies Prudhoe Bay Alaska**

Due to illness, Mr. Fisk did not attend or present his paper at the meeting. However, a printed copy of his presentation was included in the meeting materials. A brief review and summary of his presentation is provided in the next paragraph.

Mr. Fisk's presentation was on remote sensing for gas hydrates studies in Prudhoe Bay Alaska. The objective of the studies is to identify hydrate indicators, map them using remote sensing techniques, and link these indicators to leaking faults which coincide with hydrate zones. Surface indicators of hydrate zones include stained soils due to hydrocarbon seepage, gas in soils/lake surfaces, alteration zones, and vegetation anomalies. Remote sensing can be effectively used for direct detection of surface indicators. Particularly, hyperspectral sensors are useful because they acquire many images in very narrow, contiguous spectral bands throughout the visible, near-infrared (IR), mid-IR, and thermal-IR of the spectrum. Hyperspectral sensors also discriminate features with diagnostic absorption and reflection characteristics over a narrow wavelength interval that is otherwise lost with multispectral systems. Two examples of hydrocarbon detection studies showed that staining of vegetation by hydrocarbons can be detected because it has different spectral characteristics then the original vegetation or soil. Stained areas may then be linked to local petroleum sources and known fault zones. Recommendations for future work include hyperspectral flight over an area of possible seepage on the ANS (Prudhoe Bay), temporal filed spectrometer measurements for ground validation of hyperspectral flight, and generate ANS vegetation spectral library with field spectrometer.

**2.6 Ms. Barbara Moore, Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) – Department of Commerce, NOAA and Gas Hydrates**

Ms. Moore described the gas hydrate research activities at NOAA and the programs involved. NOAA's mission is to describe and predict environmental changes and to provide stewardship of coastal and marine resources to ensure sustainable economic opportunities. NOAA does not have a dedicated research program for gas hydrates, but its research is covered within the broad goals of NOAA's mission and conducted through internal research programs but mostly extramural programs. The research conducted by

NOAA on gas hydrates is covered mostly under the ecosystem goal of NOAA but also the climate goal. The specific programs involved are the Office of Ocean Exploration and Research, the Arctic Research Program, and the Climate Change Office. Specific areas of research are climate change, ocean chemistry, chemosynthetic communities, and seafloor stability.

Ms. Moore presented a few recent examples of NOAA's research. In 2004, NOAA held a gas hydrates workshop that focused on the role ocean methane and gas hydrates have in climate change. Currently, most climate models assume that hydrates have no contribution to climate change or to the carbon cycle. Key findings from the workshop were that the paradigm that oceans are an insignificant methane source is based on small, poorly constrained information and that the current global atmospheric methane budget does not accurately account for naturally occurring, geologically-sourced, fossil methane emissions. The workshop recognized the following research priorities: estimate the contribution of ocean hydrates and their relation to the carbon and methane cycles, and establish the cause/effect relationship of past spikes in atmospheric methane to episodes of climate change and the role of ocean sources.

NOAA's FY06 activities are establishing a methane hydrate seafloor observatory with DOE and MMS to study hydrate stability over time and the associated biological communities, and partnering with MMS on the environmental studies program, CHEMO III. The seafloor observatory will help understand the ecological significance of chemosynthetic communities. Ms. Moore noted that these communities are not connected to all hydrate sources. Additionally, their genetic information can be collected for potential bioproduct applications. The CHEMO III is focused on understanding hard bottom communities in depths greater than 1000 meters (M), and understanding how deep communities are similar or different from their shallow water counterparts and their sensitivities to oil and gas exploration. Future activities from NOAA will continue to focus on these core research areas.

Comments and questions were mostly directed on climate change and the role of methane hydrates, particularly from an historical perspective. For example, questions were raised on whether previous climate change events were brought about by hydrates or whether temperatures increased before or after hydrate formation. In addition MBARI and CSM mentioned positive results from NOAA support for ROV-mounted Raman spectroscopic measurements of hydrates on the seafloor at Hydrate Ridge through NURP. Ms. Moore stated that these were very interesting concepts but were not a major thrust of NOAA's projects.

### 2.7 Dr. Bhakta Rath, Naval Research Laboratory (NRL) – NRL Methane Hydrate Research National and International Activity

Dr. Rath's presentation focused on NRL's national and international activities on methane hydrate research. He summarized the key staff, national and international collaborations, and topics of interest of NRL. NRL has base funding for methane hydrates in FY06 of $830,000 and FY07 of $790,000. Additionally, related support

comes from other organizations such as the Office of Naval Research, and support in kind.

Dr. Rath next discussed NRL's use of its Deep Towed Acoustics-Geophysics System (DTAGS). He noted that the advantage of DTAGS is that it has a smaller footprint and greater resolution (due to higher frequencies) than some other conventional technologies.

Several examples of NRL's national and international activities were presented. These included activities off the coast of New Zealand, in the Gulf of Mexico, off the Chilean Coast, and off the coast of Western Europe. These activities were focused on methane hydrate characterization in these regions.

Dr. Rath concluded the presentation by noting NRL's planning and interest related to the Interagency Methane Hydrate Roadmap. Key areas of interest to NRL are global warming topics in the Arctic Ocean and Northern Pacific, international collaboration in coastal hydrate exploration, and development of low-power instruments for long-term, in-situ measurements of geologic and geochemical processes.

Comments on the presentation noted that better integration of technologies and tools, in general, is required to bring about better exploration tools. Dr. Rath was also asked if NRL receives and DARPA funds. He noted that they do not receive DARPA funds. Dr. Rath was also asked what the focus of NRL's Hydrate Initiative was, since they appear to have a limited staff but are involved in numerous activities. He said that the key areas of expertise are geochemistry, geophysics, and geoacoustics.

**2.8 Dr. Bilal Haq, National Science Foundation (NSF)**

Dr. Haq presented a short summary of the NSF's hydrates research. NSF funds academic hydrate research through its Geoscience Directorate and other programs, including ocean sciences, earth sciences, polar programs, the chemistry division, and the carbon cycle program. Activities are focused on climate change, fundamental chemistry, slope stability, marine hydrate reservoir assessment and modeling, and microbiology. Active NSF grants as of April 2006 totaled $3.7 million.

Dr. Haq presented some findings from recent drilling by the Integrated Ocean Drilling Platform (IODP) on Cascadia. Hydrates were found in several beds that were in the tens of meters thick range and at high concentrations (~80% in sandy, coarse sediment). These results are contrary to previous results where hydrates were more dispersed with lower concentrations. Additionally, occurrence and concentration of hydrates were controlled by several factors and previous models of hydrate occurrence were found to be too simplistic and need to be modified. Dr. Haq also noted that NSF is planning an Ocean Observation Initiative that is focused on the Pacific, particularly off the coasts of Oregon and Washington states.

Dr. Haq was asked how many students were involved in the research activities sponsored by NSF. He replied that each project typically has at least one student. Currently, NSF has about 12 projects, so the number of students is probably between 10 and 20. A

question was asked on what the most important parts of the planned Ocean Observatory by NSF would be to methane hydrate research. Dr. Haq responded that in-situ monitoring of hydrate dissociation was suggested.

At 12:46 PM, the meeting took a break for lunch and re-convened at 1:45 PM. Prior to the break, the agenda was modified and it was determined that the group would proceed with the two project presentations followed by discussion on the interagency roadmap. Additionally, nominations and selection of the MHAC chairman will be made.

**2.9 Mr. Robert Hunter, Alaska North Slope Corporation, DOE-BP Cooperative Project – Characterization and Appraisal of Alaska North Slope Gas Hydrate Resource Potential**

Mr. Hunter's presentation was on the DOE-BP Cooperative gas hydrate project on the North Slope of Alaska. He provided a status of research, information gained from their resource characterization and reservoir modeling, information on the stratigraphic test program, and preliminary conclusions.

This project has the goal of assessing the ultimately recoverable resource potential of gas hydrates and associated free-gas accumulations in northern Alaska, first focusing on the Eileen and Tarn accumulations and building up estimates based on studies of these formations. There are three phases to the project:

- Phase 1: Compile and assess existing data
- Phase 2: Assess regional reservoir modeling
- Phase 3: Acquire well data

The project is currently in Phase 3, having completed the first two phases in FY03-FY05. Phase 3 is scheduled for completion in FY07 but could possibly be extended to acquire additional well data and ultimately lead to a production test and pilot development.

Mr. Hunter proceeded to describe the resource characterization and reservoir modeling performed by the project. He provided a significant amount of detailed information on the characterization and modeling efforts. The project team adapted industry-standard reservoir models to gas hydrate phase behavior. The model used was developed by the Canadian Model Group and was called CMG-STARS.

There are numerous uncertainties regarding gas hydrate resources, such as rates of dissociation and production, rates of associated water production, permeabilities, saturations, endothermic effects of production, and production technologies. The Stratigraphic Test Program is one way to help mitigate some of these uncertainties and is currently the main area of focus for the project.

Preliminary conclusions from the project indicate that the ANS gas hydrate-petroleum system has complex shallow structure and stratigraphy. Theoretical modeling results to date identified a potential resource of 33 TCF of gas in place in the Eileen trend, with potential recovery of 0-12 TCF. It is estimated that it would take decades to recover the estimated 12 TCF. Uncalibrated model production rates indicate possible production

between 0-2 million standard cubic feet (MMSCF) per day per well. A comment was made that 7 MMSCF/day/well is considered economical and that hydrates are found in areas where it will be expensive to produce them, such as deepwater operations and in cold climates. Additionally, gas sampled at Milne Point in the Eileen trend was 80% saturated and contained 99% methane. Mr. Hunter noted that significant uncertainties still remain.

Recommendations to date include continuation of the Phase 3 stratigraphic test to collect additional data and calibrate development models. Ultimately, a decision will need to be made on whether to proceed with a well test program or closeout the project. It was noted that ConocoPhillips had joined the BP project.

A broad array of questions and comments were made during the presentation. Since hydrates are usually associated with free gas and can be produced without knowing, the question was asked how the project team would know it was producing gas from hydrates in stead of free gas. Mr. Hunter noted that it is difficult and that it would be years before hydrate production would occur if associated with free gas, but not all hydrate resources contain free gas. He stressed the continued gathering of stratigraphic data would help. It was asked whether there were any alternative approaches to access "sweet spots" in the permafrost. Mr. Hunter replied that the project team believes the most successful hydrates are below the permafrost and within existing infrastructure. There are other Arctic basin areas but they typically have the same problems as the North Slope, such as thin sands. A comment was made that this project is moving toward commercialization but is also collecting a lot of good, basic data and information. Mr. Hunter noted that the non-availability of drilling rigs has caused several delays in the project. Finally, Mr. Hunter indicated that the project team has published and presented non-refereed abstracts annually at meetings of the American Association of Petroleum Geologists. Recently, they have prepared a publication for the Society of Petroleum Engineers but it was deemed too sensitive because it could have lead some to believe hydrates are closer to development than most think based solely on this single project. He responded to a question, indicating that there have been no archival, refereed publications of the work to date.

**Chairman Selection**

After a short break, Mr. Johnson and Mr. Slutz reconvened the meeting and revisited the objective of selecting a chairman. Dr. E. Dendy Sloan of the Colorado School of Mines was the only nominee and was selected as chairman by acclamation. It was suggested that there be a vice-chair for continuity and to assist the chairman. However, discussion on the vice-chair was tabled and could be taken up at the next meeting.

Mr. Slutz delegated the responsibilities of the DFO to DOE Program Manager Ms. Edith Allison and briefly left the meeting to attend to other DOE business. Newly elected chairman Dr. Sloan re-convened the meeting and introduced Dr. Ray Boswell as the next presenter.

**2.10 Dr. Ray Boswell, NETL – DOE/Chevron Gulf of Mexico Gas Hydrates Joint Industry Project (JIP)**

Dr. Boswell presented information on the DOE/Chevron JIP. The objectives of the JIP, which includes several large oil and gas and industry service companies in addition to participation by various institutions, are to develop technology and data to assist in the characterization of naturally occurring gas hydrates in the deepwater Gulf of Mexico. The project is currently in Phase 2b which will evaluate/publish JIP findings through the first field test program, and improve capabilities and prepare recommendations for an additional field program. Phase 1 gathered existing data, selected drilling/coring sites, conducted pre-cruise seismic estimates and laboratory investigations, and developed new field testing equipment. Phase 2a conducted drilling/logging/coring operations. Phase 3, which will begin in 2007 will conduct further drilling/logging/coring operations.

The 2005 (Phase 2b) drilling and coring program was conducted at two locations in the Gulf of Mexico: Keathley Canyon 195 region and the Atwater Valley 14 region. Drilling issues encountered during the program included mechanical problems with the mud pumps and top drive electrical systems, and downtime due to currents. However, it was noted that the vessel did stay on location. Remote operated vehicles were deemed critical to the safe and effective operations of the drilling and coring program. It was also noted that there were inefficiencies in core retrieval apparatuses and processes. A total of seven wells were drilled, totaling more than 5,500 feet. Mr. Boswell proceeded by reviewing the various data produced by the 2005 drilling and coring program.

The JIP's findings to date include:

- subsurface fine sediment hydrate poses a minimal drilling hazard
- hydrate occurrence linked to reservoir quality
- limited areal influence of focused flow features
- potential for viable remote detection and quantification of marine hydrates confirmed
- depressurization affects critical properties in a meaningful way
- soft sediment wellbore stability model performed well

The next steps of the project include:

- ongoing investigation into acquisition of improved pressure coring tools
- preliminary meeting planned for May among DOE-USGS-MMS to review catalogue of available data and drill sites
- emphasis on sand-prone areas and high-saturation hydrates
- recommendations on future field activities by Fall 2006

In conclusion, Dr. Boswell highlighted the educational support through the JIP, noting that 13 Ph.D. candidates, post-doctorates, and master's degree students from five universities are involved.

The question was asked whether the data would change if IODP and JOIDES drilled the same sites. Dr. Boswell stated that the data would be better but would cost twice as much. Concerns were raised that if the goal is to assess the hydrate resource and none was found, DOE would be setting itself up for failure. It was recommended that there is

a need to drill enough wells to ensure that data are accurate. Dr. Boswell pointed out that the objective of Phase 1 and 2a was to calibrate. The hope is that the project will test in sand formations and eventually move to resource assessments. The issue of samples and there integrity was discussed and if there was any possibility that the project would pursue frozen samples. Dr. Boswell noted that the project team has discussed the use of liquid nitrogen to slowdown the decomposition of samples as they rise through warm water. JIP was encouraged to continue its efforts and to take a full petroleum systems approach to its efforts.

## 3. Discussion of Interagency Coordination and Interagency Roadmap

The Interagency Roadmap was the next topic of discussion at the meeting. Dr. Ray Boswell was asked to provide some initial background and perspective on the roadmap. Dr. Boswell stated that EPACT 2005 called for development of a five-year roadmap for methane hydrates research. The Interagency Coordination Committee created a long-range 20-year roadmap as a base document which would serve as the reference document for the five-year roadmap. The roadmap actively takes into account the on-going activities of other agencies. Additionally, the planning assumptions are important to understanding roadmap. The Interagency Coordination Committee members were asked to put together a plan to achieve the goals of EPACT. They were guided to first think about what R&D activities are needed for methane hydrates and perform the cost estimate afterwards. The Interagency Coordination Committee also continued to focus on collaborative government –industry partnerships to reduce risk and make commercialization of methane hydrates viable. It was noted that it takes time to build these partnerships. Another approach the United States could take is that of India and Japan, where the government is the sole organization.

Roundtable discussion on the roadmap was the focus of the rest of the day's meeting. Overall, the majority of committee members thought that the roadmap was well done but had suggestions for improvement. It was suggested that the next day's meeting also focus on the roadmap since it was considered an important topic for the Committee to consider. Additionally, the extra day would give the Committee members more time to review and comment on the roadmap. The afternoon's discussion focussed on three topics of the roadmap – the path forward, the resource roadmap, and the environmental roadmap – which are summarized below.

### 3.1 Path forward

Most members thought that the roadmap diagrams included were useful since they show where the research is and where it is headed. In the past, the goals did not really coincide with the program. It was recommended that any projects funded by DOE (or other government agencies) show how they will get you from the current state of research to some point in the future. While applied science is important, the program will need to show progress towards the roadmap goals. Additionally, flexibility in the milestones/goals was encouraged so that the program could be revised as new data is acquired. It was highlighted that something as simple as missing a permit could set a program/project back by one year, such as what happened with the JIP. Contingency

measures for projects/milestones were encouraged. Also, the document was crafted without regard to budget, but the reality is there will be constraints.

It was noted that there is some overlap in projects by agencies of the ICC, and some things that are out of focus. Given limited funding, a more focused approach by the ICC was recommended.

Another point of discussion was how the agencies will pursue education of the public. This was considered important because with several different agencies working on methane hydrate activities, the message sent to the public about methane hydrates and the federal government role needs to be coordinated and clear.

### 3.2 Resource

In the roadmap, there were three areas of emphasis: arctic resources of hydrates, marine resources of hydrates, and hydrates and their role in the environment. Most members of the MHAC thought that there was greater emphasis and more detail on the resource areas than the environment. Dr. Boswell said that the ICC was being responsive to the Act which emphasized resource potential and potential impacts. He said there may be prevalence in the document for resources but the ICC team tried to account for all the aspects required in EPACT. Some thought that the timeline for development was long, while others thought that it was shorter and mostly constrained by infrastructure. They thought that the environment area was vague and that the roadmap would be improved by elevating the status of the environmental area. Additionally, there were major concerns with parts of the roadmaps for the arctic and marine resources. First, it was noted that the arctic and marine resources will proceed at different paces.

A significant amount of discussion was spent on methane hydrate resources and reserves, particularly some of the statements in the roadmap that suggest program termination if it is determined that a particular overall level of resource is not available. Many raised concerns with this approach, stating that it might be more feasible to identify concentrations of resources that can be commercially recovered. Some felt that the numbers cited in the roadmap could be taken out of context. Additionally, some thought that there was a need to step back and re-evaluate the resource potential of methane hydrates, not just quantitatively but qualitatively. Some felt that there is a need to better understand the resource potential of methane hydrates. From an industry perspective, the push is to understand how commercial methane hydrate resources can be. Efforts need to shift away from basic science, and accelerate the timeline to get good production test to evaluate commercial aspects. It will be difficult to get industry involvement, until there is a production test. Acceleration of production tests could lead to a paradigm shift in gas hydrates development.

There was a great deal of concern about a statement on page 21 of the report which suggested that if the research program did not show significant potential in the marine environment after a second production test, then the program would be re-evaluated for

termination. Termination after two tests was considered pre-mature because some members think that more information on the resource is needed because it is not well understood. The danger is that a large valuable resource may be dismissed because of the results of two tests. Also, it was cited that there is value in a project being a technical success but not resulting in a commercially viable opportunity. The document should focus on successes. Each of these programs presented today had a success and helped move methane hydrates to the next step.

Another concern was that the roadmap placed too much emphasis on the Mallik project in 2002, although there was not concurrence about this – the Mallik2002 project was generally cited as the extant proof of concept for gas production from hydrates. While the project was very successful, the emphasis makes it sound like not much was accomplished over the past five years. Various projects have increased the knowledge of resources over the last five years. It was suggested that an opening sentence be included that states Mallik launched a whole new generation of research. Also, the statement should include that as long as the program is adding value, it should continue.

Discussion for the remainder of the session focused on why Mallik was so successful and how this success could be emulated. Some of the key aspects of the Mallik project that led to its success were:

- Fortunate coincidence of bringing together a substantial team and their requisite skills to solve a complex problem.
- Multiple international partners consisting of over 100 scientists from 6 countries. Series of papers in a holistic sense.
- Good partners and good timing was helpful.

A few background details on the Mallik project were that it was not really a production test, but a research experiment that demonstrated the ability to liberate methane by thermal stimulation.

Some additional comments on the Resource Section of the roadmap were:

- A lot of assessment data is based on seismic techniques. Non-seismic tools are available that should be evaluated in addition to the quality of data or different information that they provide.
- The roadmap refers to methane hydrates as conventional. Rather they are more conventional than originally thought but still an unconventional resource.
- The quantity and quality of data from the Program's Arctic region projects have been interesting (but unpublished) and the committee would like similar sorts of data to evolve for the Gulf of Mexico.
- It was recommended that document include more discussion on how to ground truth on the ocean floor. Some observational science on the ocean floor could be valuable.

### 3.3 Environmental

The main critique of the environmental area and section of the report was that it did not meet the standards of the rest of the report, for example, the resource sections. The environmental section was less numerical than the resource sections. Researchers have

made much progress in this area and it should be brought to the standard of the rest of the report. More difficult targets and a better perspective are needed.

A second point was that the report should dissociate human causes for destabilizing methane hydrates and their potential impacts from methane hydrate dissociation from natural causes.

Finally, from a previous meeting, it was discussed that environmental studies should be performed upfront to ensure that the environmental component is understood as you understand the resource. This was discussed in the report and received support from some members of the committee.

### 3.4 Session Wrap-up and Discussion on Tomorrow's Agenda

At 4:45, Mr. Jim Slutz returned and assumed the duties of the DFO from Dr. Edith Allison.

As the meeting adjourned for the day, the agenda for tomorrow was discussed. It was decided that the morning would begin with discussion on committee issues, followed by two brief presentations – one on the University of Mississippi Ocean Floor Observatory and one on the Roadmap document. The rest of the meeting would then focus on the roadmap document and committee recommendations/discussion for improvement. The Committee agreed to meet at 8:00 AM on April 25, 2006.

## Tuesday, April 25, 2006

## 4. Re-convening of the Meeting

At 8:04 AM, the second day of the joint MHAC-ICC meeting was called to order by MHAC chairman, Dr. Sloan. DFO Mr. Slutz made some brief remarks on the focus of today's meeting. He stated that DOE would like input into the Interagency Roadmap for Methane Hydrates. Particularly, he:

- encouraged frank, constructive criticism and that it is essential that DOE have the R&D community's input into the roadmap at this key time,
- asked the committee to look at this as a clean slate and where the program should be headed and plan on how to really make methane hydrates production happen, and
- encouraged the Committee to think big and re-iterated that the Secretary of Energy focuses on quality research that will make a difference in his lifetime. It was noted by Mr. Slutz that this was the framework for the roadmap document.

Before the presentations were made, Dr. Sloan wanted the group to discuss sites and schedules for the next two meetings of the Committee, coordination with the NPC, and other general issues and recommendations from the Committee members.

Some of the key outcomes from this discussion were:

- Written comments on the Roadmap can be submitted and are appreciated by the ICC members.
- Presentations from the meeting will be available on the FE website.
- Shorten the first day of presentations by agencies. Have these presentations focus on updates/progress reports, rather than historical activities. Alternatively, more background information can be provided by the presenting agencies in writing prior to the meeting.
- In terms of future agendas, at next meeting, start with roadmap as focus. Need to think about what is the overall problem.
- Report to congress from the committee is due by August 2007. Think about timing for next two meetings.
- The next meeting of the MHAC is tentatively schedule for November 8 and 9, 2006 in Houston, TX. Dr. Nader Dutta of Schlumburger Inc. will report back on the availability of their facilities for the meeting.
- The next spring meeting is scheduled for Golden/Denver, CO on April 24 and 25, 2007.
- It was suggested that meetings be held near project sites so that the Committee could take advantage of some of the hands-on activities that are being performed.
- Washington, DC was also suggested as a site for future meetings because of the convenience of having Federal officials nearby that can attend the meetings.
- It was suggested that prior Committee letters to the Secretary of Energy be made available to the current committee. It was noted that the letters are on the website.
- It was recommended that the MHAC extend an invitation to the NPC to present at its next meeting to open dialogue on the differing opinions of the two committees on methane hydrates and to provide the MHAC with the opportunity to provide input into the next NPC report on global oil and natural gas which is due in May 2007. Dr. Dutta will coordinate the MHAC's efforts with the NPC because he has a connection with Rod Nelson of Schlumburger Inc. who is a member of the NPC.
- It was suggested that the committee focus today's meeting on developing a set of coherent recommendations on the roadmap.

### 4.1 Other General Comments and Clarifications

It was suggested that there be interagency consolidation to make efficient use of funding resources. Dr. Boswell noted that most of the agencies bring unique capabilities to the group and their activities supplement other programs of agencies. There is some overlap in areas, but for the most part, it is minimized.

It was suggested that interagency coordination move from the technical level to the management/strategic level. It was noted that the interagency roadmap attempts this by engagement of counterparts and is a senior government wide effort. The Hydrogen Program was cited as an example.

It was suggested that future meetings be held for two full days so members have more time to engage each other on important issues.

The roadmap was identified as an excellent starting point but there is more room for discussion and creativity is a major component.

It was suggested that the MHAC think outside of the box, regarding the program, but there needs to be a balance between these concepts and more conventional ideas.

## 5. Presentations

### 5.1 Dr. Robert Woolsey, University of Mississippi – Gulf of Mexico Gas Hydrates Research Consortium and the Gas Hydrates Seafloor Observatory in Mississippi Canyon Block 118 Presentation

Dr. Woolsey made a brief presentation on the Consortium and the Seafloor Observatory. He began by identifying the partners of the project and noted that they are not under any cost obligation and can come and go as they please.

He next showed a map of the location of the observatory and noted that the area was a very geologically active zone. There are three main vents and some peripheral vents that are episodic.

He proceeded by showing several slides on the configuration of the seafloor observatory and discussed some of the key technologies being used: thermistor arrays to record thermal data, acoustic vertical liner arrays and horizontal cross arrays to capture surface noise, and buoys for information collection.

Dr. Woolsey presented some initial findings by the observatory:

- Bottom Simulating Reflector (BSR) is moving on a time-scale of days/weeks
- Flowing sands – high content of silica around salt domes resulted in no hydrates being found
- Monitoring thermal gradient over time

Dr. Woolsey noted that they do not have a well-defined BSR and that the BSR is at 200 meters depth. He also noted that the hydrate stability zone is moving up and down due to inherent pressure and that they have not collected electro-geophysical data but others have in the past.

Since this was a Congressionally "earmarked" project, several questions were asked on what action the committee needed to take and about earmarks in general. Earmarks were defined that they are included in legislation and specify that a certain amount of money is available for some organization to perform some type of activity. The Committee was guided that it should feel free to comment on earmarks since the project is part of the program. DFO Mr. Slutz noted that DOE and the Administration oppose earmarking and think it is counter to a good research plan.

### 5.2 Dr. Ray Boswell, NETL – Draft Interagency Long-Term R&D Roadmap

Dr. Boswell presented a brief overview of the Interagency Roadmap for Methane Hydrates. From EPACT 2005, he said that they must submit a five-year plan by the end

of 2006. This long-term roadmap is to set the context and goals for the five-year plan. The structure of the roadmap focused on fulfilling the goals of EPACT 2005 regarding methane hydrates. The roadmap has received interagency input, and maintains the policy of keeping the program aligned with industry. When developing the roadmap, the ICC worked under the guidelines that they are not budget constrained. The roadmap describes the accomplishments of the past five years and includes an interagency collaboration brochure as an addendum.

The remainder of Dr. Boswell's presentation focused on the key sections of the report, namely the draft roadmap figures and discussion for arctic and marine resources, and for the environmental aspects of the program. Dr. Boswell noted that tapping marine resources are the key, but arctic resources in Alaska are a starting point for testing production technologies. Some of the key activities required for arctic resources include:

- Development of delineation, drilling and production technologies through the BP project;
- Obtainment of a series of prolonged well tests with: alternate production scenarios, alternation completion methods and well designs, and under a variety of reservoir conditions; and
- Support for model development and laboratory work.

For the Gulf of Mexico, key activities include:

- Field tests to ground-truth technology,
- Confirmation/determination of the scale of resources, and
- Utilization of lessons learned from arctic research to conduct production tests.

The same logic used for the arctic roadmap (exploratory work and resource assessment, production testing, and finally a multi-well pilot program) was also used for the marine roadmap. However, the marine roadmap included a series of off-ramps where, if the resource, production potential, or economic potential at various points did not meet the goals, a re-evaluation of the methane hydrate program would be considered.

The environmental area of the roadmap focused on three key activities:

- Natural de-gassing,
- De-gassing associated with exploration and production activities, and
- Periodic 3-D (and 4-D) surveys to monitor effects.

There are two key goals for natural de-gassing:

- 2015: sea-floor sampling and monitoring, as well as laboratory and modeling study to constrain methane fluxes from sediment to water to atmosphere.
- 2025: Major issues with hydrate in the natural environment are resolved (not limited to Gulf of Mexico.

For de-gassing associated with exploration and production, the focus is on:

- Integrate environmental activities with resource-related projects, and
- separate joint efforts with industry – before, during, and after monitoring.

Dr. Boswell was asked if the Federal researchers have some type of Memoranda of Agreement with industry that they will provide certain data. He noted that they currently have two, on-going projects. They realize that industry has data and access to land so it is a good idea to leverage and find mutual interest.

The question was asked regarding the roadmap for the Gulf of Mexico and whether, after only a second production test, that the scale of resources in the Gulf of Mexico can be confirmed. The Department of Interior has been tasked to determine the recoverable resource in the Gulf of Mexico. They will provide a range of probable amounts of potential resource, most likely using 5%, 50%, and 95% as the probabilities. It was thought that one good test in the right spot will allow the scale of the resource to be quantified. However, there was concern that the limited testing should not be taken out of context the roadmap. Deepwater oil was given as an analogy because not many wells were drilled but it was still pursued as an option. Today, it is a significant resource.

Other questions were asked regarding the funding shown in the roadmap figures and any constraints. The Act authorizes amounts for the first five years so the roadmap was fit to that scale.

## 6. Discussion of the Interagency Roadmap

After Dr. Boswell's presentation discussion ensued for the rest of meeting on the roadmap and MHAC input and recommendations.

### 6.1 Budget

A MHAC member asked whether the committee has any input on budget allocation. It was noted that MHAC is an advisory committee to the Secretary of Energy and that the committee could recommend areas where more or less funding is required. Additionally, they were advised that it is not a "zero-sum" game (i.e., MHAC, when commenting on the budget, does not have to constrain itself to the budget proposed by DOE and other agencies in the roadmap. MHAC can recommend more or less funding.). A clarification was made that, since this is an interagency roadmap, appropriations will move through different committees. It is a complex process that can not be thought of as in corporate terms, where issues can be prioritized. Regarding the budget, it was suggested that the roadmap include or breakout the budget for international collaboration since it is a major element for future development activities. Additionally, it was advised that the roadmap identify the mechanics and structure for international collaboration, particularly since several agencies will be involved. These activities need to be structured and coordinated.

### 6.2 Environmental Issues

Given the information and what has recently been reported regarding climate change, some thought that the 2025 environmental goal in the roadmap, that major issues with the environment will be resolved, was overly optimistic. It was noted that this is a goal for the program and that it should be set high.

It was suggested that the next meeting include a brief presentation on water columns and hydrates to raise awareness of environmental issues.

It was suggested that in the MHAC report to Congress that the environmental program and proposed studies in the roadmap be given more thought. More specificity will be needed s we move forward. Dr. Boswell noted that interagency 5-year plan will include more specificity.

It was brought to the attention of the attendees that a workshop funded by NOAA in Boulder several years ago focused on methane impact on global climate change. There were some good ideas and suggestions for experiments from the workshop that could be included in the roadmap. It was suggested that this information be reviewed.

**6.3 Break at 10 AM.**
Prior to the break, Mr. Slutz delegated responsibilities of the DFO to DOE Program Manager Edith Allison.

Chairman Sloan re-convened the meeting at 10:17 AM and suggested that the rest of the discussion of the meeting focus on the roadmap and that a series of recommendations be developed. By May 12, DOE needed feedback in terms of written recommendations. Copies of comments could be sent to Dr. Boswell.

The ensuing discussion focused on the following key areas: Resources, Environmental Issues, MHAC business issues and input to the roadmap, and formation of subcommittees to develop recommendations for the roadmap.

**6.4 Resources**
Comments on the Resources Section of the roadmap mostly focused on the roadmap goals and quantification/assessment of the resource. Many comments were made on the roadmap inclusion of a less than 500 TCF assessment of recoverable hydrate resources in 2008 as an off-ramp. Most found this to be too early for an assessment and could lead to premature termination of the program. The basis for this concern was that some members thought that not enough tests are being performed to accurately assess the recoverable resource by this date. It was suggested that the sentence be deleted or that it not be tied to a particular number because good prospects for development could possibly be left behind because an arbitrary number was not reached. The Department of Interior-MMS noted that they only committed to a technical recoverable assessment by 2008 and that it will include a range of values. An economic assessment would be a separate task.

A comment was made that there may not be a need for very specific decision points such as the 500 TCF assessment in the roadmap, because the majority of well-supported programs in DOE do not have milestones of this nature. It was pointed out, contrary to this comment, that the DOE Hydrogen Program does specify specific dollar/cost milestones. It was also commented that DOE is committed to numerical, quantifiable milestones and that this has possibly been a constraint to the program.

There was some discussion that the MHAC was not thinking in big enough terms. The DOE Carbon Sequestration Program was cited as an example of a program that was thinking in a grand scale, with efforts such as FutureGen and the Regional Sequestration Partnerships. There needs to be a paradigm shift in methane hydrates and thought should focus on making hydrates commercial. Constraints to development of the resource need to be addressed to make development possible. It was again cited that the production technology for methane hydrates is relatively close to commercial-scale, but infrastructure and markets are necessary. The gas-to-liquids (GTL) market was mentioned as a possible consideration. Additionally, there is a need to move from science to industry development of methane hydrates. Industry needs to be involved and need to encourage people to invest in methane hydrates as a livelihood. Communication, technology, and willpower are required to move methane hydrates forward.

A comment was made that the Roadmap, as a whole, places most of its emphasis on the Arctic and Gulf of Mexico. A plan was needed to move beyond these two and understand what the global hydrate resource is. A plan is needed to move beyond these two areas.

A specific comment was made on Figure 4 of the roadmap on installation of monitoring stations. It was mentioned that more detail is needed on what is to be monitored, how many monitoring stations are required, etc.

Another problem is, scientifically, researchers are at the mercy of the driller at the production site. Frequently drilling could not do what they wanted due to constraints in field. From industry perspective, industry is keen on learning, regarding hydrate development, what is breakeven point in arctic, marine, and Gulf of Mexico to make this viable. The most common question is, "What is the breakeven gas price in the Gulf of Mexico and Arctic," which is not an easy question to answer. The committee encouraged the roadmap to move forward with goal of identifying what price is required for commercial production.

There was some concern that the BP project was the foundation for some of the expectations and goals in the roadmap. It was noted that other wells may be available that could be lower cost. It is important that these other opportunities are not overlooked. It was mentioned that other opportunities were not an area of very strong emphasis in roadmap. The following section captures the discussion on "wells of opportunity."

*6.4.1 Wells of opportunity*

The problem with new proposals for collecting data is that they have long lead times. For example, a new proposal with the IODP can take four years. Therefore, "Wells of Opportunity" were discussed as potential low-cost, short timeframe opportunities to collect data and information. Loosely defined, these are wells where data could be collected and assessments enhanced by using existing information. For example, data could be collected by MMS from nearly abandoned wells. These wells also represent a low-cost opportunity to collect significant amounts of data, possibly at $2 million.

It was suggested that a dialogue begin with industry on collection of methane hydrate data. Currently, industry avoids areas of methane hydrates due to the potential drilling problems or does not care about collecting data because they are only concerned with conventional gas production. However, industry has drilled a lot of wells and data exists, so it could be useful to make them aware of methane hydrate data needs. It was suggested that MMS work with industry in pursuit of these opportunities.

On existing wells, downhole piston cores are one potential source of high-quality data. Combining this data with data collected from a platform and a huge amount of information can be generated. While data from the holes already drilled more than likely will be incomplete, it can still provide a good snapshot of the resource.

It was suggested that long piston cores, mud logs, and logging while drilling measurements could provide a lot of information. Additionally, it is not critical that core samples be exact; by the time they arrive for simulation the have been modified, homogenized, etc.

It was suggested that more collaboration with industry or industry organizations such as the American Petroleum Institute (API), is needed to collect core and seismic data and other pieces of information. However, the methane hydrate research community needs to be coordinated when dealing with industry so that a clear message is sent

Alternatively, while there is a need to be open to industry, there are complications, such as dealing with numerous partners. The methane hydrate research community needs to be open to other avenues (such as government research or incentives for development) if industry does not want to partner or assist on "wells of opportunity." "Wells of opportunity" are just a part of the activities and should not be all encompassing.

Finally, MMS mentioned that they have invited the Joint Industry Project to Metairie, LA in July to discuss their work on the isopaching of sand to draw in on permissive areas in Gulf of Mexico and find wells of interest. Additionally, BP has recently sold shallow Gulf of Mexico areas to Apache which could be suitable depending on whether the area is in the hydrate stability zone.

### 6.5 Environmental Sub-committee

It was again noted that the environmental section of the roadmap needs to be elevated to the same level as the resource section. It was suggested that a subcommittee on environmental issues be formed to develop recommendations for the roadmap on an environmental studies program. The subcommittee will build upon information from the presentations.

### 6.6 International Sub-committee

It was also suggested that a sub-committee be formed to review the successes and failures in international activities. Global efforts need to be monitored and evaluated and there is a need to know if other areas –such as the Atlantic and Indian Oceans are successful

development areas. International collaboration should appear in arctic and marine roadmaps.

**6.7 Alternative Energy Scenario Sub-committee**
An alternative energy Scenario sub-committee was also formed to look at events that could trigger high prices or the need to rapidly accelerate the methane hydrates program. The sub-committee would also develop potential actions. A fourth sub-committee on exploration and production was considered but was combined with the alternative energy scenario sub-committee.

**6.8 MHAC business issues and timeline issues**
MHAC members were urged to send specific comments on the roadmap by email. The meeting should focus on conceptual ideas.

Regarding the subcommittees, their recommendations will be reported to the whole MHAC committee who will ratify them.
DOE/Office of Oil and Natural Gas would like to have the roadmap issued by the end of May so that concepts can be included in the FY2008 budget request. Therefore, they would like to have the preliminary recommendations from MHAC by May 12, 2006. More complete recommendations can be completed by the November meeting.

It was suggested that it would be helpful to have a list of committee members called "hydrates" so that information can be efficiently distributed.

**6.9 Other comments**
Regarding exploration and production, a recent workshop in Alaska went into great detail on exploration and production. This information is available on the Alaska state website: http://www.dggs.dnr.state.ak.us/AlaskaGasHydratesIntro.htm . This information could help provide input at minimal effort.

**6.10 Working Lunch**
During lunch, the sub-committees met to develop bullets/paragraphs for discussion and input into the roadmap. These would be presented after lunch.

**6.11 Presentation and discussion of sub-committee outputs**
After lunch, the sub-committees presented their recommendations and items for discussion.

*International Sub-committee*
- Conceptual statements
  - International collaborations are an important aspect of program
  - There is potential to shorten timelines
  - Need to understand what the timelines of other countries are, for example India and Japan are hoping for commercial development in 2008 and 2010 respectively
  - US focus should be on technology sharing and platforming

- Constraints
  - Industrial policy (what does industry want to share)
  - International focus and goals – each country has different perspective

- Other important considerations
  - US foreign policy
  - Rationale for methane hydrates research
  - Leverage technology
  - Financial commitment
  - Other nation's schedules – Can U.S. keep up?
  - Expansion of energy availability
  - World methane hydrate database expansion

The question was asked if it is a negative if the U.S. is not leading the world in the effort to develop methane hydrates. As long as the U.S. is collecting the data, some thought it was not a negative. However, it was mentioned that it matters a lot to Congress. There is a perception that America is losing its technological lead. Balance is what is important and that the U.S. is involved in as much international research as possible to help leverage limited funding.

It was suggested that a table be prepared to identify aspects and expertise, goals and focus, man-years that other countries are putting together. A similar table was previously put together for another effort and could be a template.

Several examples were also cited where industry contributed a small amount of funding but had access to all the data and did not have a leadership role. Unocal was cited as a specific example where they showed up for meetings, and collected information and data, but only contributed 3% of the total project funds. Additionally, Shell was cited as a pioneer in the deepwater Gulf of Mexico but others (so-called "early settlers" in the deep water) gained significant amounts of knowledge based on Shell's work.

*Environmental Sub-committee*
The Environmental Sub-committee report focused on both global climate change and methane releases (both human and natural de-gassing) and environmental concerns regarding production of methane hydrates

- Baseline delineation of the existing situation (a report about 50-pages long) is needed; There are some documents in existence which might be used as templates
- Need to understand the current state of knowledge and environmental fate of methane hydrates
  - What is known, what are the controlling issues – such as watercolumn data, GIS database of existing methane plumes around the world, methane release today via oceanic vents, etc.
- Need to know who will perform baseline assessments
- Need to understand the environmental impact on organisms and biological communities
  - Which are potentially perturbed and which should we be most concerned.

  - Need to understand which environmental impacts to avoid or minimize.
  - Need to be cognizant that these organisms and biological communities may have other uses
  - Need to answer whether the environmental effects are major or negligible.
- Believe there are produced water issues, which can potentially destabilize the watercolumn.
  - As produced water is discharged, what are the biological, chemical, and physical effects. Do they accelerate release of methane to atmosphere?
- How are marine resources of methane hydrates assessed? Are they Type 1 or Type 2 resources and to what extent are the effects of type 1 or 2 resources on gulf of Mexico if released?
- Need to understand the geohazards of methane hydrate production.

A comment was made that most of the sub-committee's report focused on marine resources of hydrates. On-shore was considered less of a concern by the sub-committee because it was similar to current industry practices for recovery of conventional natural gas. It was mentioned that this should be included in the roadmap.

It was agreed that produced water is a major issue, but it could also be a benefit. There are a lot of issues regarding produced water and what to do with it.

It was noted that the hydrate stability zone in the gulf of Mexico could act as a buffer for leaking of conventional gas. Natural gas could be produced at the base of the hydrate zone to prevent release. Industry's perspective is that a leaky resource seal could drain the largest field very rapidly. A hydrate seal could, over time, seal or effectively trap the resource.

*Alternative Energy Scenario Sub-committee*
The alternative energy scenario sub-committee focused on what could be done to accelerate the program if events trigger the need for rapid increase of natural gas supply.

Some triggers included:
- Another hurricane season such as 2005
- Brownouts
- Cutoff of import supplies

Resources focused on the Arctic region and the Gulf of Mexico
Arctic region
- Identify areas where maximum potential can be addressed and can federal and state lands be used to access areas
- Ability to test gas hydrate and associated free gas
- Dedicated drilling platform not in competition with industry actions
- Short-circuit the process by providing incentives
- End result: working production test facilities to test alternatives
- Expand on work by BP to explore existing and new technology applications within existing infrastructure

Gulf of Mexico
- Seismic data – multicompany seismic monitoring/different reflectors at depth
- manipulate software and deploy mass spectroscopy for detection and analysis around seafloor

Big Picture Items
- Comply with environmental regulations and limit adverse effects
- Offshore production adds whole new level of complexity
- Create a challenge to direct and accelerate methane hydrates research
- Identify the "future prize"
- Accelerate technology – Possibility of $CO_2$ injection into hydrate reservoir
- Leverage existing funds and recognize linkages with $CO_2$ sequestration and other programs.
- Capture value of large amounts of seismic, well and other data in the Gulf of Mexico and Alaska to constrained volumetric numbers.
- Work with government to validate strategic direction
- Quickest way to accelerate production – "just do it" concept (begin production testing at best prospects)
- Develop one-month long think tank on issues

One comment was that there were a lot of good ideas presented, but there needs to be a realization that significant problems can happen really fast with a small number of triggers and the effects on the economy could be large. The items in the presentation are good for 10 years but need to have some shorter range ideas.

Some members liked the idea of the "just do it" concept to begin production tests.

Another comment was on incentives to expedite this technology, particularly focusing on royalty relief and assuring fair market value. How do you apply royalty forgiveness when you do not know what the resource is, prices or other incentives? MMS has published two advanced notices of proposed rulemakings in the Federal Register on royalty relief for hydrates and sequestration but response has been minimal. However, some commented that not many people have the opportunity to actively review the Federal Register so they may miss some things.

It was suggested that one way to accelerate development is to create a challenge and make it available to all. If industry steps up and participates, that would be great, but the challenge needs to be known.

## 7. Meeting Wrap-up and Adjournment

Before concluding, Chairman Sloan asked DFO Ms. Allison for any concluding remarks. Ms. Allison noted that yesterday when ASFE Jeff Jarrett attended, he was concerned about comments that were made loosely about lobbying Congress for funding. DOE general counsel requested that the MHAC members read tab 7 of their meeting binder,

"Advisory Committee Ethics Law Summary" and to call Sue Wadel of the Office of the Assistant General Council for General Law if they have any questions. While it is encouraged that members speak freely and openly, they must be cognizant about some casual statements that are made during the meeting.

Chairman Sloan challenged the three sub-committees to develop their draft comments by 3 PM and to submit them to both him and to Dr. Boswell. Chairman Sloan offered the members the chance to add any concluding remarks and adjourned the meeting at 1:27 PM.

E. Dendy Sloan, Chairman

Arthur Johnson, Interim Chairman

James Slutz, Designated Federal Officer

Attachment:
May 3-4, 2006 Methane Hydrate Advisory Committee Meeting Attendees

| **Methane Hydrate Advisory Committee Meeting** | | |
|---|---|---|
| **Attendee List - April 24, 2006** | | |
| **Last Name** | **First Name** | **Organization** |
| Allison | Edie | U.S. Department of Energy |
| Boswell | Ray | National Energy Technology Laboratory |
| Brewer | Peter | Monterey Bay Aquarium Research Institute |
| Charter | Richard | Resources Legacy Fund Foundation |
| Cox | Virginia | U.S. Department of State |
| Dutta | Nader | Schlumberger |
| Elwood | Jerry | U.S. Department of Energy |
| Haq | Bilal U. | National Science Foundation |
| Hunter | Robert | ASRC Energy Services |
| Jarrett | Jeffrey | U.S. Department of Energy |
| Johnson | Arthur | Hydrate Energy International |
| Juenger | Kimberly | ConocoPhillips |
| Kastner | Miriam | Scripps Institute of Oceanography |
| LaBelle | Bob | Minerals Management Service |
| Mahajan | Divinder | Brookhaven Science Associates |
| Masutani | Stephen | Hawaii Natural Energy Institute |
| Moore | Barbara | NOAA |
| Pierce | Brenda | U.S. Geological Survey |
| Rath | Bhakta | Naval Research Laboratory |
| Shope | Tom | U.S. Department of Energy |
| Sloan | E. Dendy | Colorado School of Mines |
| Slutz | James | U.S. Department of Energy |
| Swenson | Robert | Alaska Department of Natural Resources |
| Transtrum | Trudy | U.S. Department of Energy |
| Whelan | Jean | Woods Hole Oceanographic Institution |
| Wilson | Scott | Ryder Scott Company |
| Woolsey | Robert | University of Mississippi |

| Methane Hydrate Advisory Committee Meeting | | |
|---|---|---|
| **Attendee List - April 25, 2006** | | |
| **Last Name** | **First Name** | **Organization** |
| Allison | Edie | U.S. Department of Energy |
| Boswell | Ray | National Energy Technology Laboratory |
| Brewer | Peter | Monterey Bay Aquarium Research Institute |
| Charter | Richard | Resources Legacy Fund Foundation |
| Cox | Virginia | U.S. Department of State |
| Dutta | Nader | Schlumberger |
| Elwood | Jerry | U.S. Department of Energy |
| Hunter | Robert | ASRC Energy Services |
| Johnson | Arthur | Hydrate Energy International |
| Juenger | Kimberly | ConocoPhillips |
| Kastner | Miriam | Scripps Institute of Oceanography |
| Mahajan | Divinder | Brookhaven Science Associates |
| Moore | Barbara | NOAA |
| Rath | Bhakta | Naval Research Laboratory |
| Sloan | E. Dendy | Colorado School of Mines |
| Slutz | James | U.S. Department of Energy |
| Transtrum | Trudy | U.S. Department of Energy |
| Whelan | Jean | Woods Hole Oceanographic Institution |
| Wilson | Scott | Ryder Scott Company |
| Woolsey | Robert | University of Mississippi |